Surname		Other Names	
Centre Number			Candidate Number	
Candidate Signature			

For Examiner's Use

General Certificate of Education
January 2007
Advanced Subsidiary Examination

AQA
ASSESSMENT and QUALIFICATIONS ALLIANCE

ENVIRONMENTAL SCIENCE **ESC3**
Unit 3 The Biosphere

Wednesday 17 January 2007 9.00 am to 10.00 am

You will need no other materials.
You may use a calculator.

Time allowed: 1 hour

Instructions

- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Answer the questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The maximum mark for this paper is 60.
- The marks for questions are shown in brackets.
- You are reminded of the need for good English, clear presentation and appropriate use of specialist vocabulary. Question 6 should be answered in continuous prose. Quality of Written Communication will be assessed in this answer.

For Examiner's Use			
Question	Mark	Question	Mark
1		5	
2		6	
3			
4			
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

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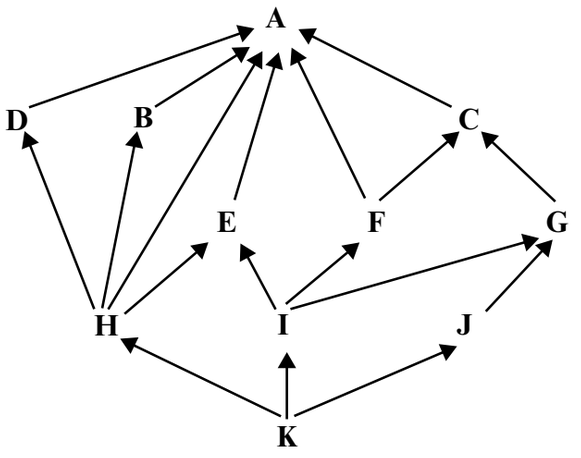
Answer **all** questions in the spaces provided.

1 The diagram shows part of a food web where letters represent the different organisms present in the ecosystem.



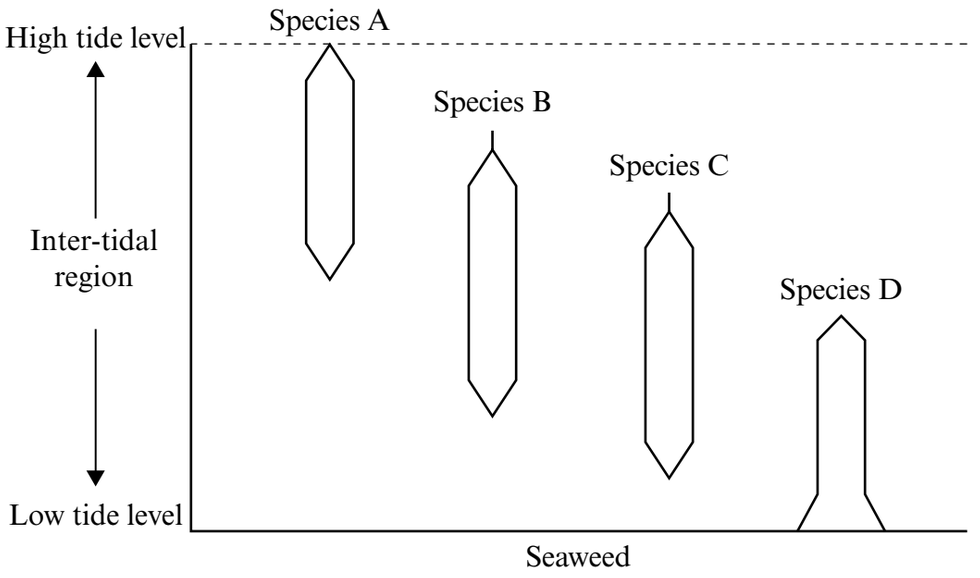
Choose an appropriate letter from the diagram to complete the table. You may use the same letter once, more than once, or not at all.

	Letter
A primary producer	
A secondary consumer	
An organism that feeds at more than one trophic level	
An organism that would be least efficient at converting the energy it receives into new growth	
An organism at the fourth trophic level	

(5 marks)

5

2 An investigation was carried out into the distribution of species of seaweed on a rocky shore. Some of the results from a belt transect are shown in the diagram.



(a) What term describes the distribution of seaweed species on the shore?

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(1 mark)

(b) (i) Explain how a belt transect would be used to obtain the data shown in the diagram.

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(3 marks)

(ii) Explain why a belt transect was the appropriate method to use for this investigation.

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(1 mark)

(c) Suggest **two** reasons for the distribution of the seaweed species shown in the diagram.

1 .....

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2 .....

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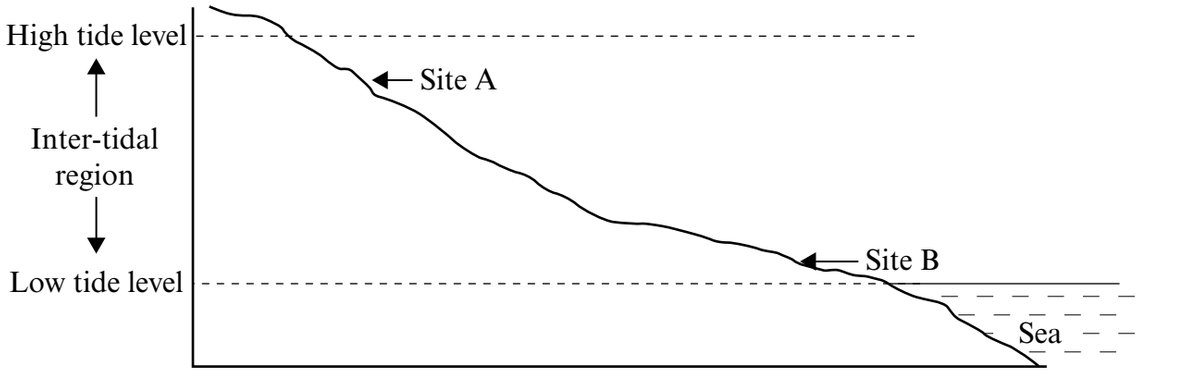
(2 marks)

(d) The diagram shows the profile of a rocky shore. Two sites were studied. Site **A** was on the upper shore and Site **B** on the lower shore.



The table shows all the seaweeds found growing at Sites **A** and **B**.

Site A – upper shore	**Mean number per m^2**	**Site B – lower shore**	**Mean number per m^2**
Ascophyllum nodosum	2	*Corallina officinalis*	31
Fucus spiralis	10	*Fucus serratus*	8
Fucus vesiculosus	4	*Laminaria digitata*	15
Pelvetia canaliculata	6	*Laminaria hyperborean*	3
		Laminaria saccharina	6
		Laurentia pinnatifida	18
		Palmaria palmata	6
Index of diversity		Index of diversity	4.77

(i) Use the formula to calculate the index of diversity for the seaweeds growing at Site **A**. Show your working.

$$\mathbf{d = \frac{N(N-1)}{\Sigma n(n-1)}}$$

where **d** = index of diversity
N = total number of organisms of all species
n = total number of organisms of a particular species
Σ = the sum of

Answer .....
(2 marks)

(ii) Give **one** advantage of calculating an index of diversity rather than just recording the number of species present.

.....

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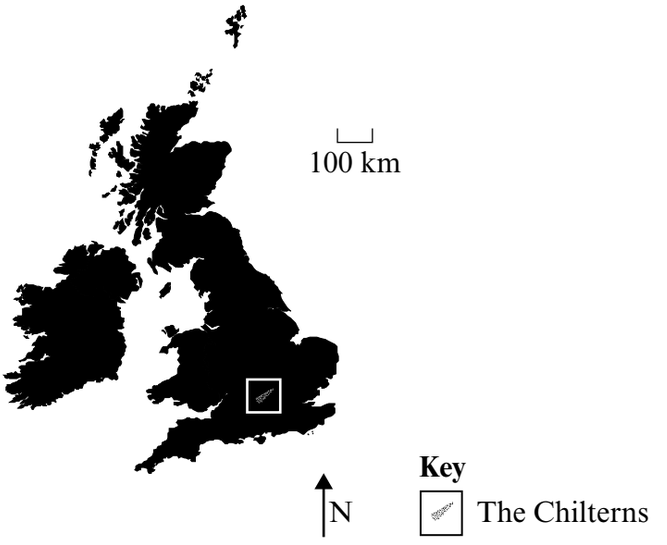
(1 mark)

10

Turn over for the next question

3 The Red Kite *(Milvus milvus)* used to be a very common bird in Britain but it became extinct in England through human persecution. A small population survived in the remote hills of mid-Wales. Between 1989 and 1994, wild kites from Spain were imported and released into the Chiltern Hills.

Red Kite (*Milvus milvus*)



Source: M LANGMAN (RSPB)

Source: *Chilterns Conservation Board*

(a) Suggest why it was decided to import birds from Spain rather than breed from the small remaining population in Wales.

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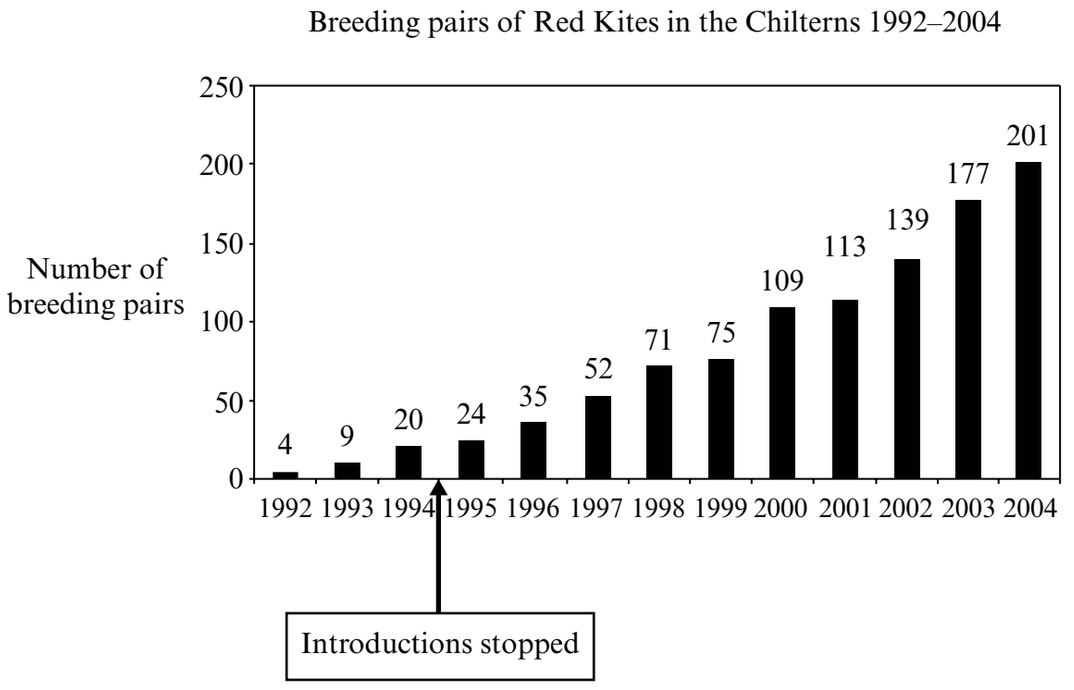
(2 marks)

(b) The graph shows the number of breeding pairs of Red Kites in the Chilterns between 1992 and 2004.



Source: *The Southern England Red Kite Group*

(i) Suggest why the number of Red Kites is increasing in the Chilterns.

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(2 marks)

(ii) It is hoped that the Red Kite population in the wild will eventually reach the carrying capacity. Explain what is meant by the term *carrying capacity*.

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(1 mark)

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(c) Outline methods, other than re-introductions from other areas, that can be used to prevent the possible extinction of animal species.

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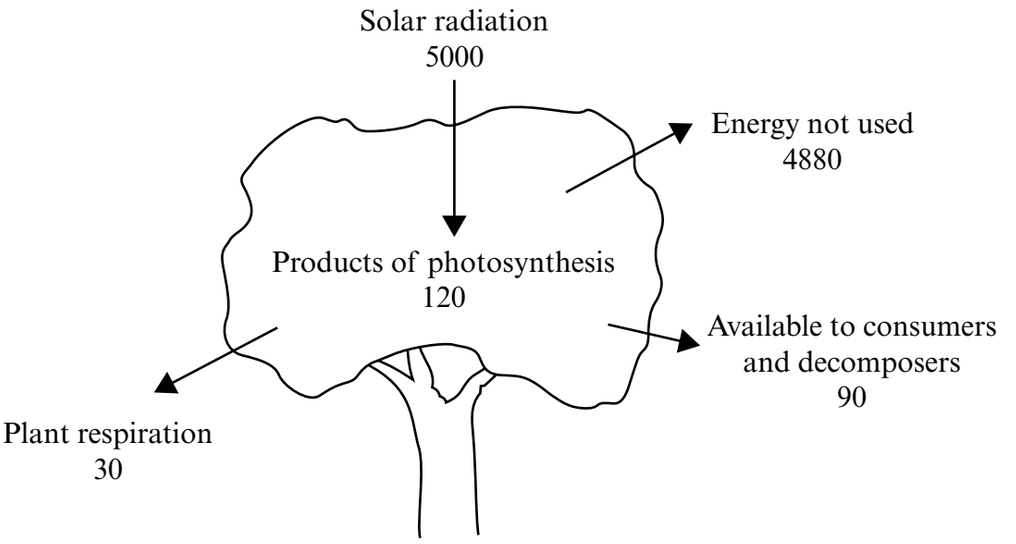
(5 marks)

10

Turn over for the next question

4 The diagram shows the flow of energy through trees in a woodland ecosystem. The numbers represent mean inputs and outputs of energy in kJ m^{-2} day^{-1}.



(a) Use the information in the diagram to calculate the percentage of solar energy that is fixed in photosynthesis.

Show your working.

Answer .....

(2 marks)

(b) Not all the solar radiation reaching the leaves of the tree is used in photosynthesis.

Give **three** explanations for this.

1 .....

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2 .....

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3 .....

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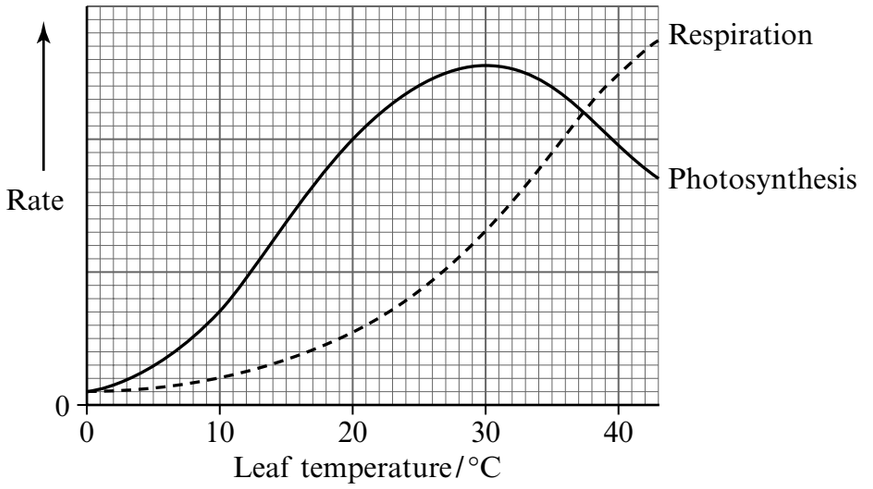
(3 marks)

(c) The graph shows the rates of photosynthesis and respiration in leaves at different temperatures.



(i) Shade the area of the graph where there would be a net increase in tree biomass. *(1 mark)*

(ii) Explain why the rate of photosynthesis decreases when the leaf temperature exceeds 30 °C.

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(2 marks)

(iii) What is respiration?

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(2 marks)

10

5 (a) (i) Explain what is meant by an abiotic factor.

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(1 mark)

(ii) Use an example to explain how an *abiotic factor* exerts a density-independent effect on a population.

Example .....

Effect .....

.....

(2 marks)

(b) Describe how the mark-release-recapture method (Lincoln Index) is applied to estimate the size of a population.

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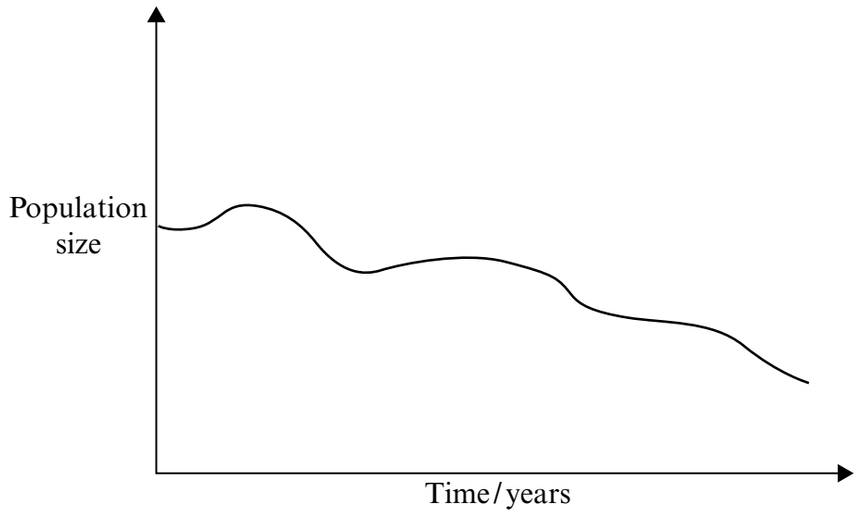
(3 marks)

(c) The graph shows changes in the population size of breeding adult frogs *(Rana temporaria)* in a nature reserve.



Suggest **three** biotic factors that may account for the variation in population size shown in the graph.

1 .....

2 .....

3 .....

(3 marks)

(d) Rearrange the terms in the list below to write an equation to illustrate a stable population size.

births
deaths
immigrants
emigrants

.....+.....=.....+.....

(1 mark)

10

Turn over ▶

6 (a) State the purpose of **each** of the following designations.

(i) Special Area of Conservation (SAC)

.....

.....

(1 mark)

(ii) Site of Special Scientific Interest (SSSI)

.....

.....

(1 mark)

(iii) Special Protection Area (SPA).

.....

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(1 mark)

(b) Explain why designating a site could be both an advantage and a disadvantage to a landowner.

Advantage .....

.....

Disadvantage .....

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(2 marks)

(c) Outline the problems of conserving **one** UK habitat and describe the methods used to overcome these problems.

Quality of Written Communication will be assessed in this answer.

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(10 marks)

15

END OF QUESTIONS